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ABSTRACT

The third report of the 'Buildings in Use' study specifically addresses those aspects of a building that directly support user activity. These are areas of 'activity support' exclusive of furniture that include studies of specialized areas and functions within the school as well as storage, classroom display, window usage, and some activity support equipment. Measures in this area include capacity, anthropometric fit, and amount of usage. (Author/MLF)

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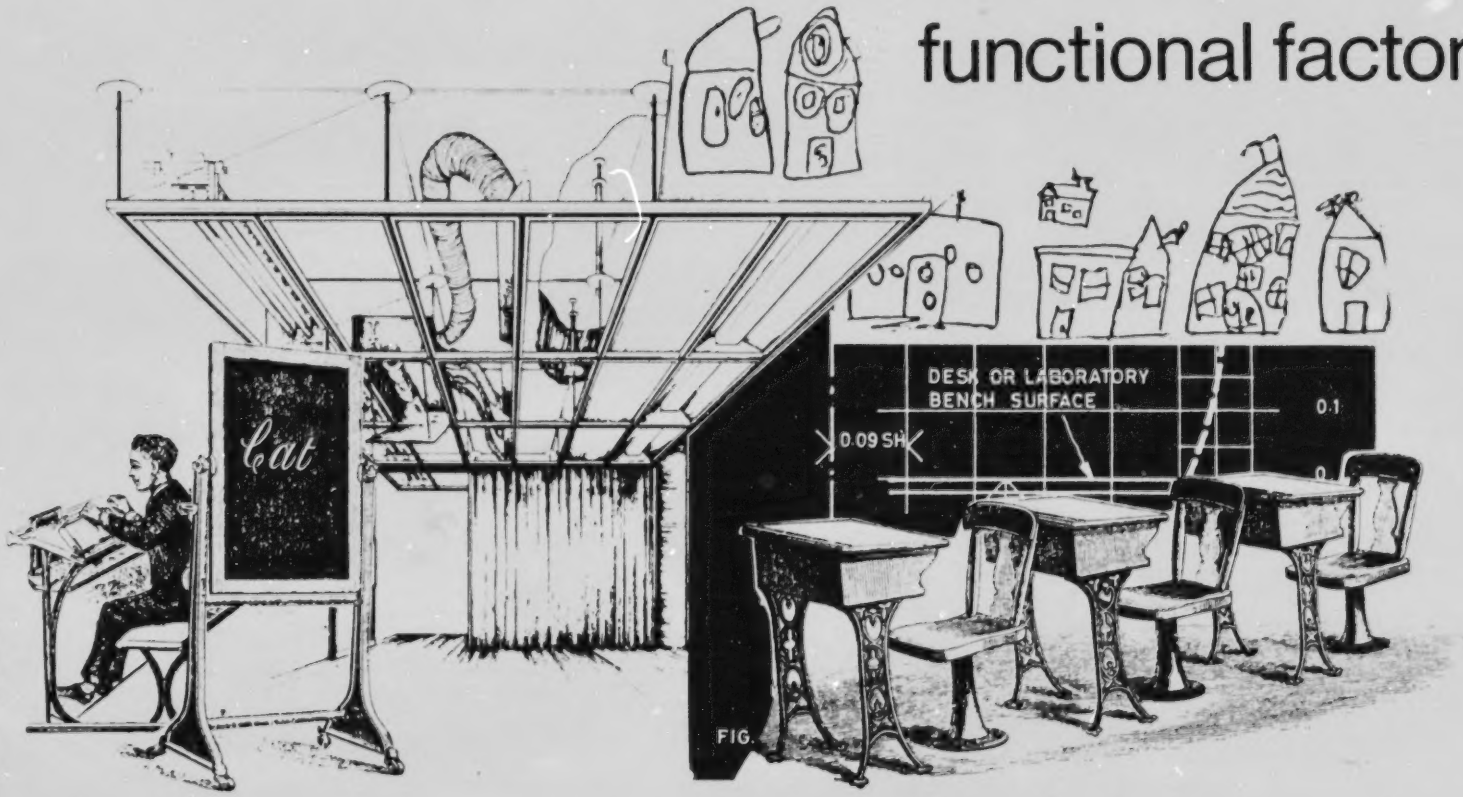
buildings in use study

functional factors



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PARTICIPANTS

PROJECT DIRECTOR ..... H. Z. RABINOWITZ
RESEARCH ASSISTANT ..... FRANCIS KRUPKA
GRAPHICS ..... V. JAMES, H. Z. RABINOWITZ

INTRODUCTION

THE STUDY

Those responsible for buidings rarely examine, in a formal and comprehensive manner, the environment they have helped create. We believe that such examination is, however, the primary method through which better buildings can be created. Thus, what we learn from this study can be used--by clients and architects--in the design of future buildings.

This report is one product of the "Buildings in Use" study. The overall study examines architectural characteristics of existing buildings to determine how they have performed technically and functionally and the relationship between the environment of the building and the behavior of its user population. This working document specifically addresses the functional aspect of the study. Other aspects--technical, field tests, behavioral--are covered in other reports.

FUNCTIONAL FACTORS

Functional factors, as we define them, are those aspects of a building that DIRECTLY SUPPORT USER ACTIVITY. For instance, floors, ceilings, or acoustics do not directly support user activity--we consider these the 'background' environment. A blackboard, a closet and an electrical outlet do directly support user activities and performance in elementary schools. Furniture was not included as a part of this study though it is a part of the functional/activity support system.

Functional/activity support systems can be categorized by the scale of the support object. This report is generally organized from small scale items to rooms.

- small built-in components--coatracks, blackboards, bulletin boards
- storage--shelves, cabinets or closets
- entire areas specifically designed for special activities--music, art, library, reading, etc.

For various reasons the architect is primarily concerned with the latter two of the above mentioned areas. Architects' efforts are given to thinking about and shaping spaces to respond to intended usage and to 'servicing' these activities with storage. This effort is evident in the way these areas are configured, the way the 'background' environment--structure, lighting, acoustics--is detailed, the careful thinking about the connections between these areas and the location and design of storage and services for them.

The first category--component scale 'items' of activity support--is usually, though by no means universally handled by choosing catalog, or 'typical', items and 'attaching' them to the room surfaces in a routine manner. This attitude reduces the potential effect of this activity support scale at best and can even result in problems related to correct function. This report documents cases of quite conscientious manipulation of this small scale of activity support to produce behaviors very reinforcing of activity and a more routine attitude which results in potential deficiencies.

METHODS OF EVALUATION

For each factor discussed we have attempted to use objective measures in examining performance.

1) Anthropometric measures: relates to the measured dimensions of the element to the fit to a person's (or a child's) measure.

2) Measured use: regularly sampled observations of actual use.

3) Questionnaire data

4) Photographic documentation

5) Unobtrusive measures: ad hoc solutions, physical traces, records.

6) Room inventory

The criteria used in analyzing various functional elements are noted in the appropriate sections. If possible criteria are derived from standard sources; however, some criteria were developed from an analysis of observed phenomena.

HUMAN FACTORS

SUMMARY

Human factors is the study of human dimensions and attributes related to the design of objects which people use, primarily equipment. Included subjects of this section are chalkboards, cabinets, sinks, toilets, and drinking fountains. The performance of these items 'in use' is primarily measured by comparison with the standard dimensions of their users.

In addition to dimensional criteria the performance of chalkboards is also measured for performance related to glare affecting visibility. The provision of adequate display area from quantitative and qualitative performance standpoints is a part of the direct human factors 'interface' of person and environment and is also part of the component scale of activity support. Existing standards and actual use are contrasted to the design of display in all four schools.

ANTHROPOMETRICS

Performance Required: Provice components which are dimensionally compatible with the users of the schools.

Method: Comparison of dimensions of certain critical components of the school with existing standards. Sources include Time Saver Standards, Complete Guide to Planning New Schools, N. Englehardt, The Measure of Man, 2nd Edition, H. Dreyfuss.

Analysis:

ANTHROPOMETRICS

	STANDARDS GRADES 1-3	STANDARDS GRADES 4-6	P 1-3	P 4-6	R 1-3	R 4-6	S 1-3	S 4-6	M 1-3	M 4-6
CHALKBOARD(bottom)	25"	29"	18"	24"	30"	30"	33"	33"	28"	32"
CAFETERIA COUNTER	31"	36"			35"		31"	36"	36"	
DRINKING FOUNTAIN	27"	32"	26"	32"	28"	28"	30"	32"	28"	34"
SINK	26"	29"	24"	30"	26"	26"	28"	30"	26"	32"
WATER CLOSET(seat)	11"	14"	16"		16"		16"		16"	

Findings: A comparison between existing standards and the actual dimensions indicates some discrepancies of which a few are critical. At the Richards and Smith School blackboard height is a real problem in the lower grades. A few teachers mentioned that 'platforms' were necessary to reach the chalkboard. Other items, though not standard, are within an acceptable range.

CHALKBOARD GLARE

Performance Required: Provide chalkboard with adequate contrast to read chalk writing.

Method: Comparison of performance with existing reflectance standards. Use of reflected and incident lighting measures. See Field Test Manual - Section G.

Analysis: Criteria: 'Black' chalkboards reflectance levels should not exceed 20%; it shall be free from visible 'ghost lines'; source: SCSD Performance Specifications.

CHALKBOARD GLARE

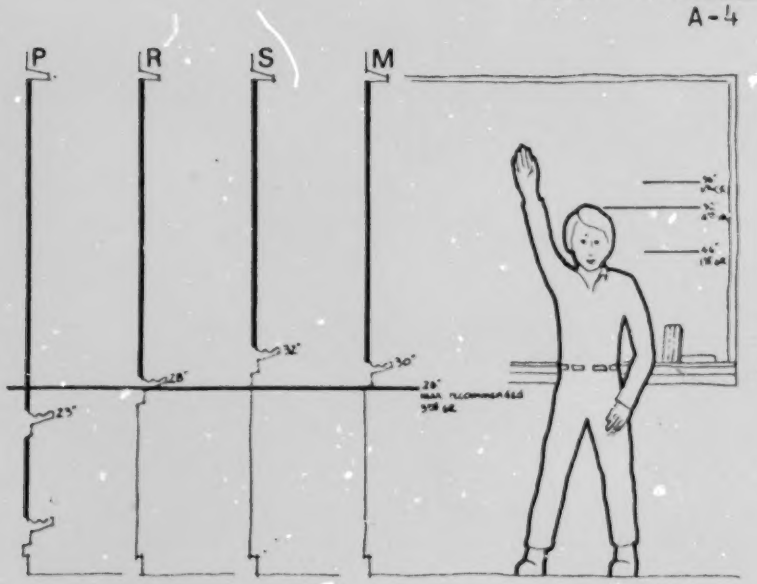
	RECOMMENDED STANDARDS	P	R 1*	R 0*	S
PERPENDICULAR POSITION	20% Max. Refl.	7%	10%	7%	10%
WORST SEAT POSITION	20% Max. Refl.	43%	10%	29%	45%

1* no window near board
o* window perp. to board

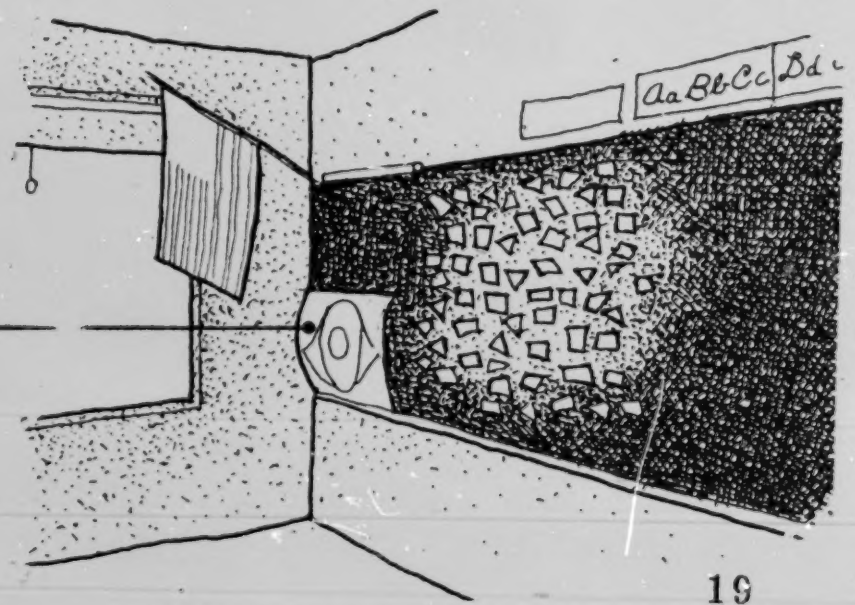
A combination of chalkboard placement and window size and location produce veiling reflections (inability to read writing on board) when window shades are not drawn at the Parkside and Smith School. Very serious glare (approx. 40%) is present. When shades are drawn performance is satisfactory. At the Richards School performance is generally satisfactory.

'BUILDINGS IN USE' STUDY

BLACKBOARD DIMENSIONS

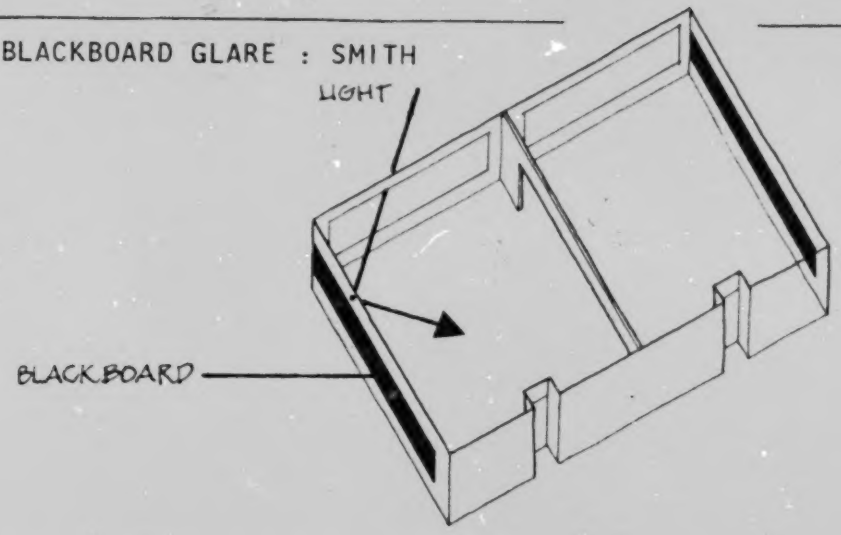


BLACKBOARD GLARE

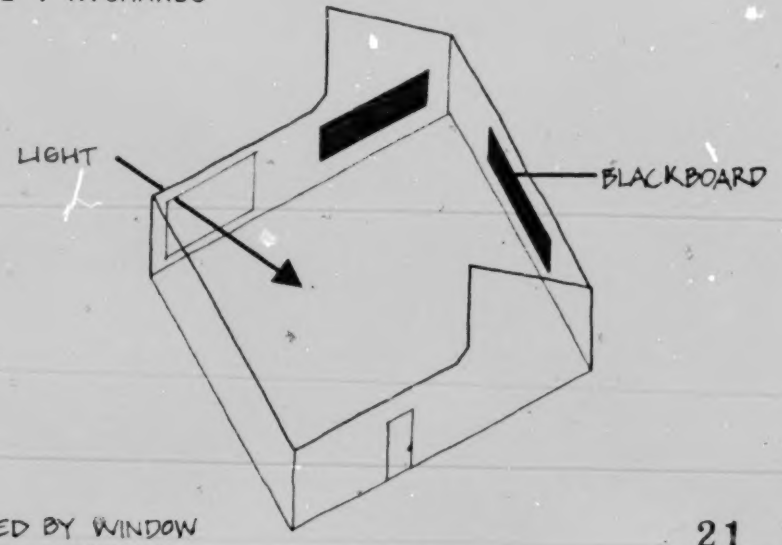


A-5

BLACKBOARD GLARE : SMITH



BLACKBOARD GLARE : RICHARDS



GLARE IS MINIMIZED BY WINDOW LOCATION IN REAR OF CLASSROOM

DISPLAY

Performance required: Provide adequate area and attributes for displaying materials especially drawings, visuals, etc., in the school.

Method: Existing standards were found. A comparison of existing standards and actual quantity of display area is classrooms was made. Photographic sampling was used to measure the amount of display actually used. Ad hoc solutions to display were documented.

Analysis:

DISPLAY AREA

	RECOMMENDED STANDARDS	P	R	S	M
QUANTITY (linear feet)	30	20	20	30**	30
QUANTITY (square feet)	75*	80	80	60**	120

*this published standard was found to be low
**largely unusable due to placement

The quantity of display ranges from a less than usable 60 sq. ft. at Smith School to 120 sq. ft. at Mt. Healthy.

The findings have as their basis the assumption that maximizing opportunity for display usage within reasonable boundaries is called for. Many teachers will utilize these opportunities fully, some less and a few not at all - the latter emphasizing alternative media or methods.

Our observations found 'overflow' display in most classrooms except Mt. Healthy where display space was adequate. At Smith the overflow often occurred on the blackboard next to the window where glare is worst, this adaptation resolved the use of this problem area; on the window shades - they are often closed; in the hallway, although it is difficult to hang pictures on raw concrete; and in some case from the light-fixtures using paper clips and string. The displayed objects in this and the other schools were varied-primarily students drawings, educational charts and visuals, teacher cut outs, etc.

At the Parkside and Richards Schools the existing display area was well used with some overflow onto the walls. Richards School block walls are easily used for display compared to the brick back wall at Parkside where in some uses teachers have strung a 'clothesline' to hang pictures, cut outs, and constructions. At Mount Healthy display is rampant and most surfaces in classrooms and corridors are used.

Findings: We believe that approximately 25 linear feet (100 sq. ft.) of display space would be sufficient for most teachers. Most surfaces should be tackable and some provision should be made for ceiling attachment. Provision should also be made for display in corridors. Based on the above the Smith School needs quite a bit more useful display area and the Parkside and Richards Schools need only another increment, say 4-6 linear feet, of display. At Mount Healthy the display area is sufficient.

STORAGE/AUDIOVISUAL

SUMMARY

Both storage and the provision for using audiovisual equipment are crucial services for the well functioning elementary school. Expanding amounts of technical means for transmitting information and the use of sophisticated materials and other media have become conventional, even in elementary education.

Adequate storage is an important service in an elementary school. Very large amounts of material, of all sizes and shapes, are used throughout the school year. Access needs to storage also vary - some items are needed daily, some are used only once or twice a year. The performance requirements measured in our study were storage capacity, type and accessibility.

Supporting the use of audiovisual equipment is also critical in the schools studied. Performance requirements were storage and accessibility for audiovisual equipment, electrical connections and the ability to darken the room adequately for viewing projected images.

STORAGE CAPACITY

Performance required: Provide adequate storage for classroom and school needs.

Method: A comparison of the 'official' storage provided and the actual use of storage - both official and unofficial. A detialed storage 'inventory' of most classrooms was made, including photo documentation.

Analysis:

STORAGE CAPACITY

	STANDARD*	P	R	S	M
STORAGE CAPACITY PROVIDED PER CLASSROOM (cu.ft.)	250 (approx)	146	155	182	350

*standard developed through analysis of existing conditions

The originally specified storage capacity has increased for each new school. This wide range of alternatives is a good 'experiment' against which to test the performance of storage capacity.

'Overflow' storage was consistatnly and obviously evident at the Parkside, Richards and Smith Schools. Every cubic foot of storage space provided was brimfull as well as numerious other locations. Shelves in many cases were literally deflecting with the weight of their loads. Most shelf storage was multilayered - the objects being piled atop one another also creating problems in organization and disarray.

At the Parkside and Richards Schools overflow storage took place on the floor, in cardboard boxes and on folding tables. Occasionally a storage cabinet would be brought in from home by a teacher. At Smith most overflow storage occurred in the nodes in metal cabinets and steel shelving though the 3'x6' folding tables were again used in the classroom.

The Mt. Healthy School has sufficient built-in cabinetry and mobile cabinets, some of which went unused.

Findings: Based on these very consistant results we would recommend 250 cubic feet of storage area be provided for each classroom. Centralized storage needs would require an additional 50 cubic feet for each classroom.

SIZE OF STORAGE

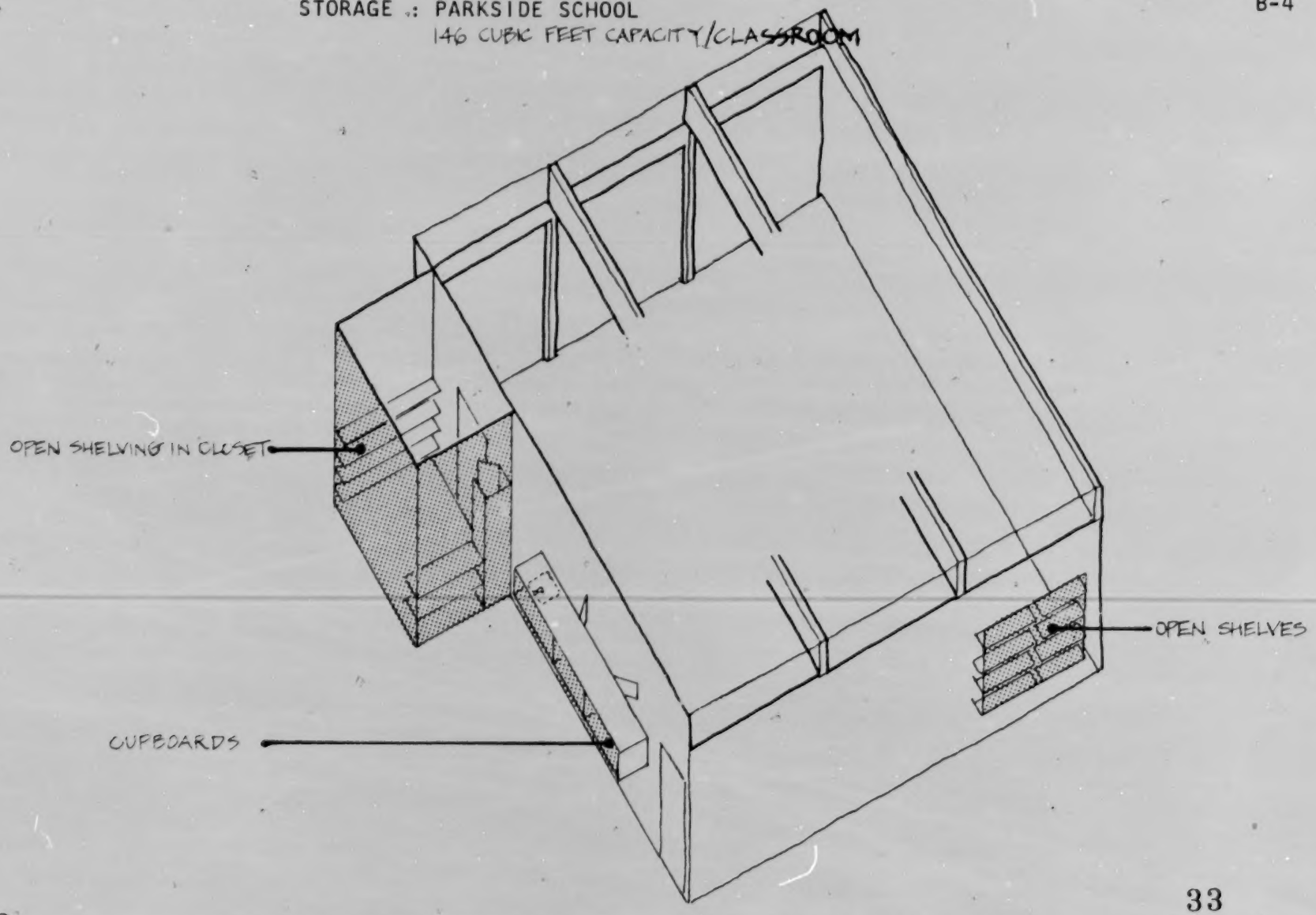
Performance required: Provide storage for objects of various sizes.

Method: See 'Storage Capacity".

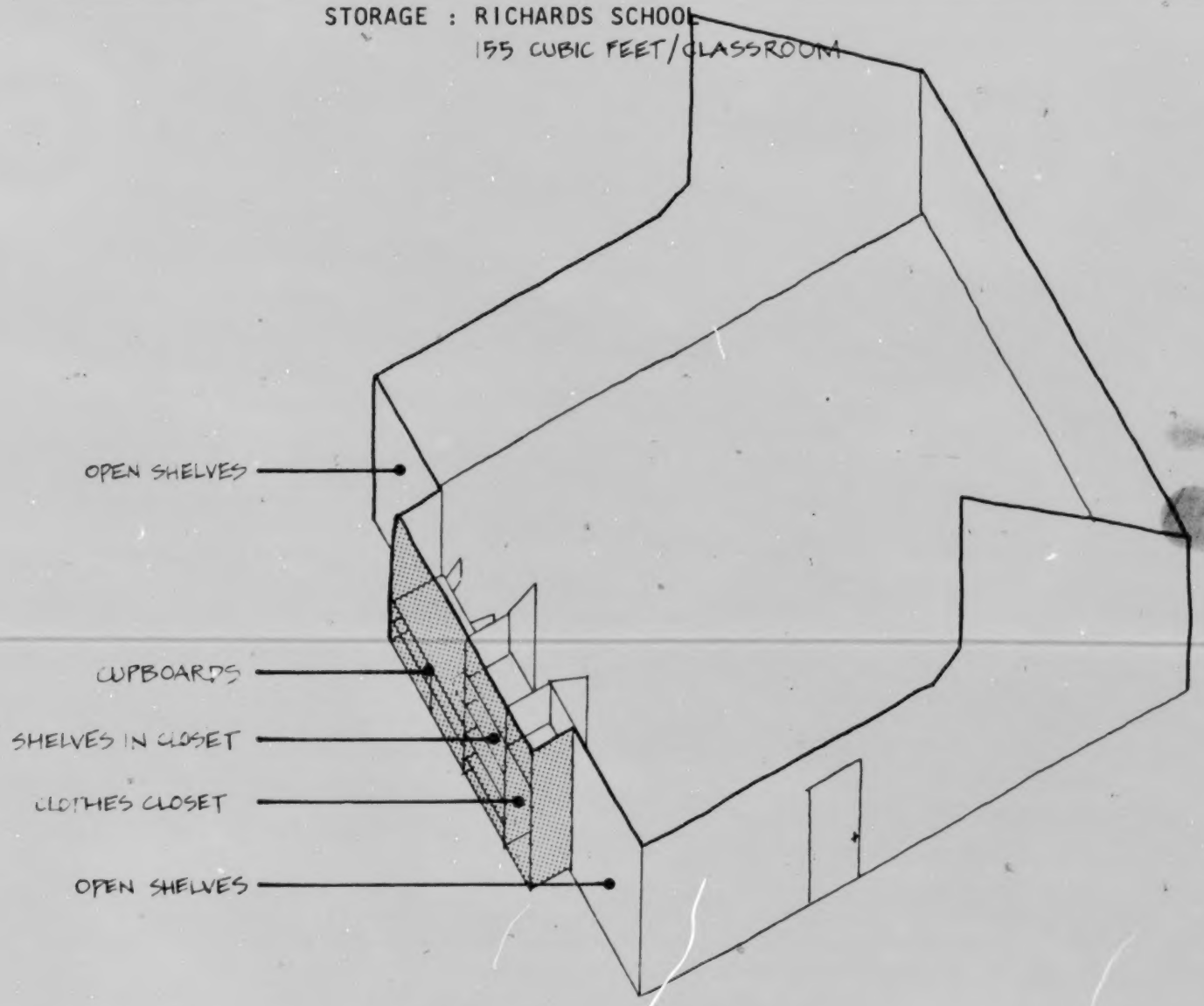
Analysis: There is a storage problem for all sizes of objects related to the lack of storage capacity. Universally displaced, however, are those large objects, say over 15 inches in all dimensions, for which the shelving systems and drawers make no provision. This includes:

- most audiovisual equipment
- screens and charts
- instructional media kits and sets
- globes
- recess equipment
- easels
- large models (eg. clockface, earth and moon)
- fish tanks
- plants
- fans
- cardboard boxes of miscellaneous objects

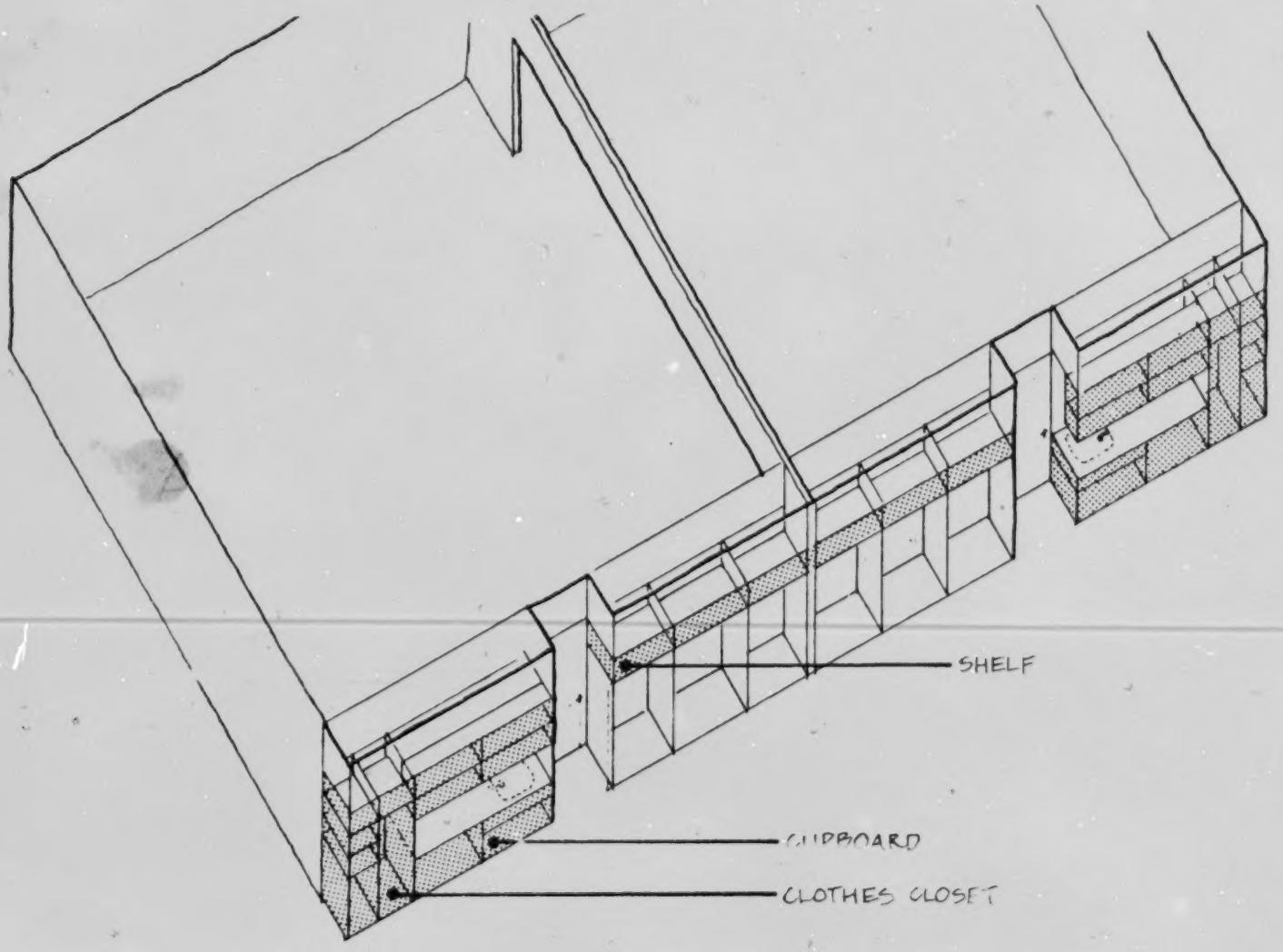
STORAGE : PARKSIDE SCHOOL
146 CUBIC FEET CAPACITY/CLASSROOM



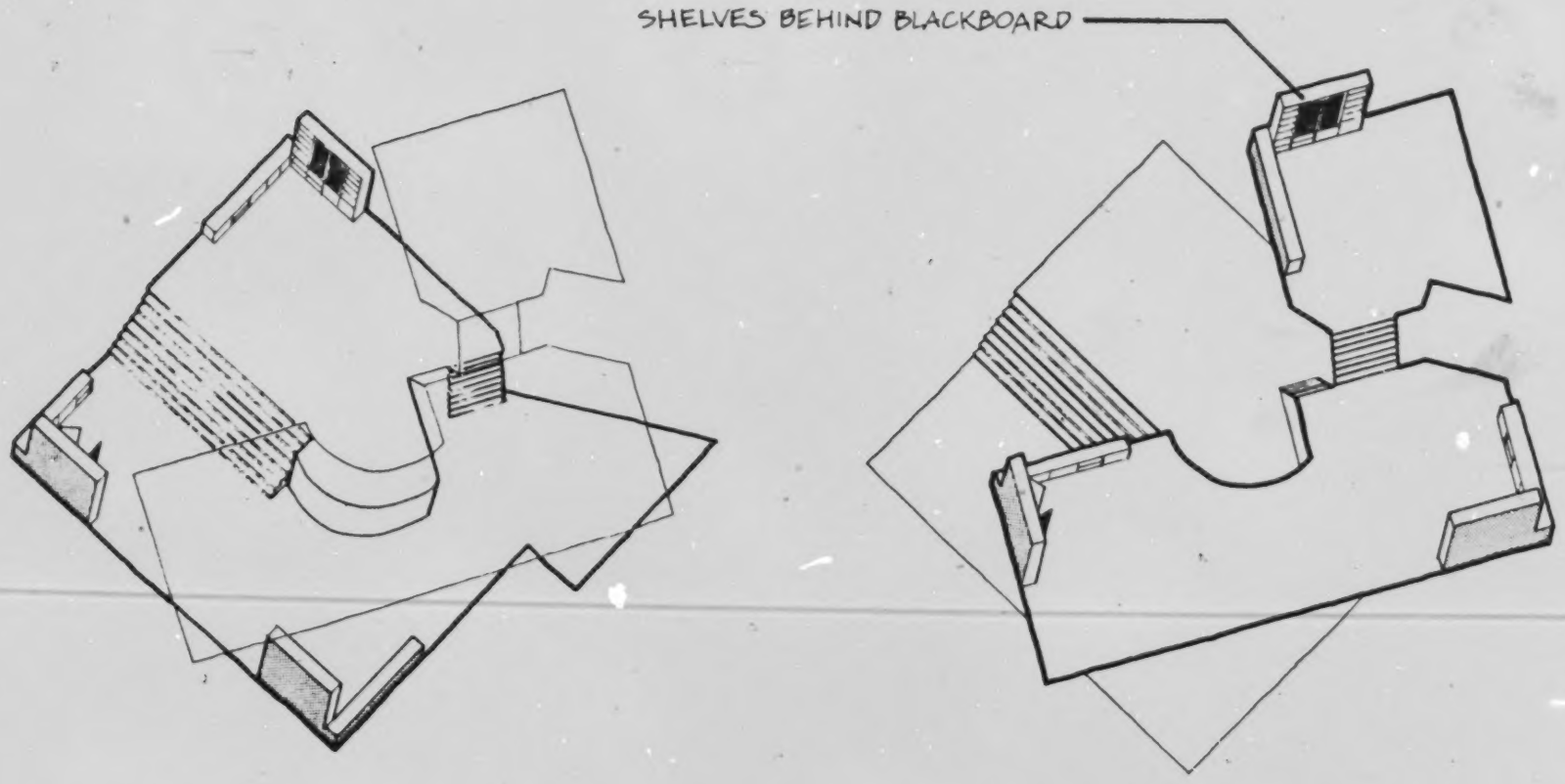
STORAGE : RICHARDS SCHOOL
155 CUBIC FEET/CLASSROOM



STORAGE : RICHARDS SCHOOL
182 CUBIC FEET/CLASSROOM (DOUBLE CLASSROOM SHOWN)



STORAGE : MT. HEALTHY SCHOOL
350 CUBIC FEET/CLASS AREA (6 SHOWN)



At the Parkside and Richards School these are found on the floor or on tables. At Smith approximately one-third of the built-in coat closets have been appropriated for large object storage. At Mt. Healthy there is adequate capacity for objects of all sizes.

Findings: The mix of storage needed should change to include the accommodation of large space objects.

LENGTH OF STORAGE

Performance required: Provide short term and long term storage.

Method: See 'Storage Capacity'

Analysis: The need for accessibility to storage can be categorized as follows:

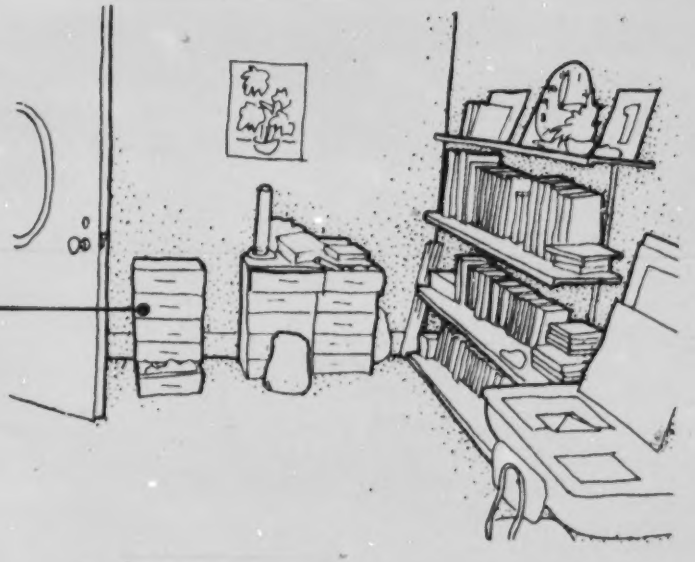
- immediately accessible storage. Items used almost daily includes crayons, chalk, paper or of all kinds, recess equipment, cleaning equipment books.
- short term storage. Items used regularly but not often. This category includes most audiovisual equipment, toys and games, educational media (flash cards, games), paints, books.
- long term storage. Infrequently used objects, included are Christmas decorations and equipment, globes, abacus, a fan, charts, decorations, textbooks.

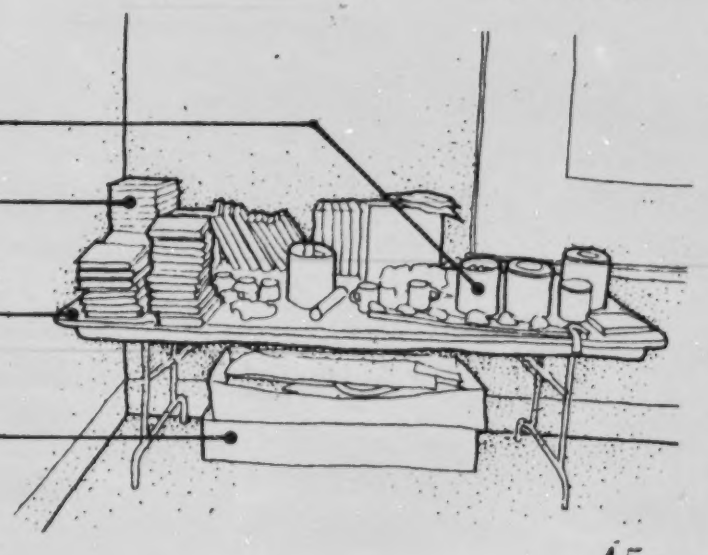
In the Parkside, Richards and Smith Schools there has been adequate provision for immediate and some short term storage by the type and location of storage provided. Storage is virtually all within the classroom and consists principally of shelves and

drawers. At Parkside and Richards long term storage and audio-visual equipment storage is present in the classroom and handled via various ad hoc solutions mentioned previously. At Smith the nodes have become 'opportunity spaces' where a variety of originally unprogrammed activities have occurred including area for a great amount of long term storage. Even at Mount Healthy there is some need for separate long term storage most of which is now stored in an ad hoc fashion in the team teaching room though there is still some capacity remaining in classroom storage.

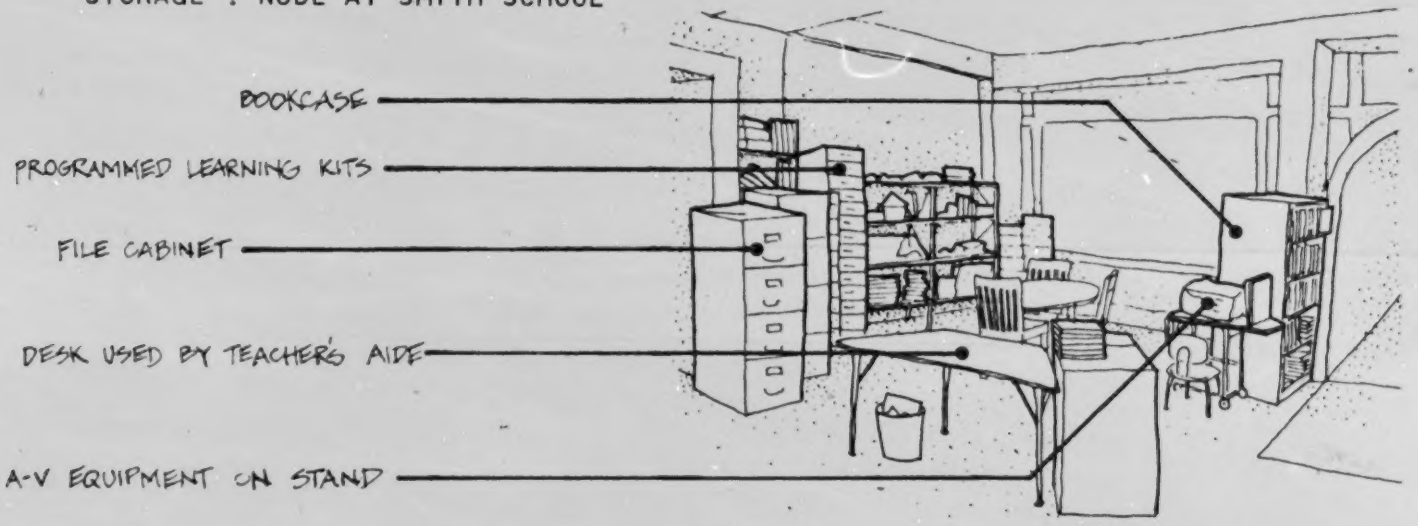
Another need for shared immediately accessible storage exists at some of these schools. At the Richards and Smith Schools programmed instruction materials are shared by a few classes and the storage and accessibility of these materials presents a problem. In both schools these materials are stored on metal shelving in corridor areas outside of the classroom proper. At Richards the constraining, enclosing walls of the classroom does not encourage free flow to these materials. The corridor is not a suitable environment for them. At Smith the node/corridor where they are stored does present problems but the environment is enhanced by the presence of teachers aides and additional resources, study carrels, etc.

TYPICAL STORAGE
Parkside and Richards Schools

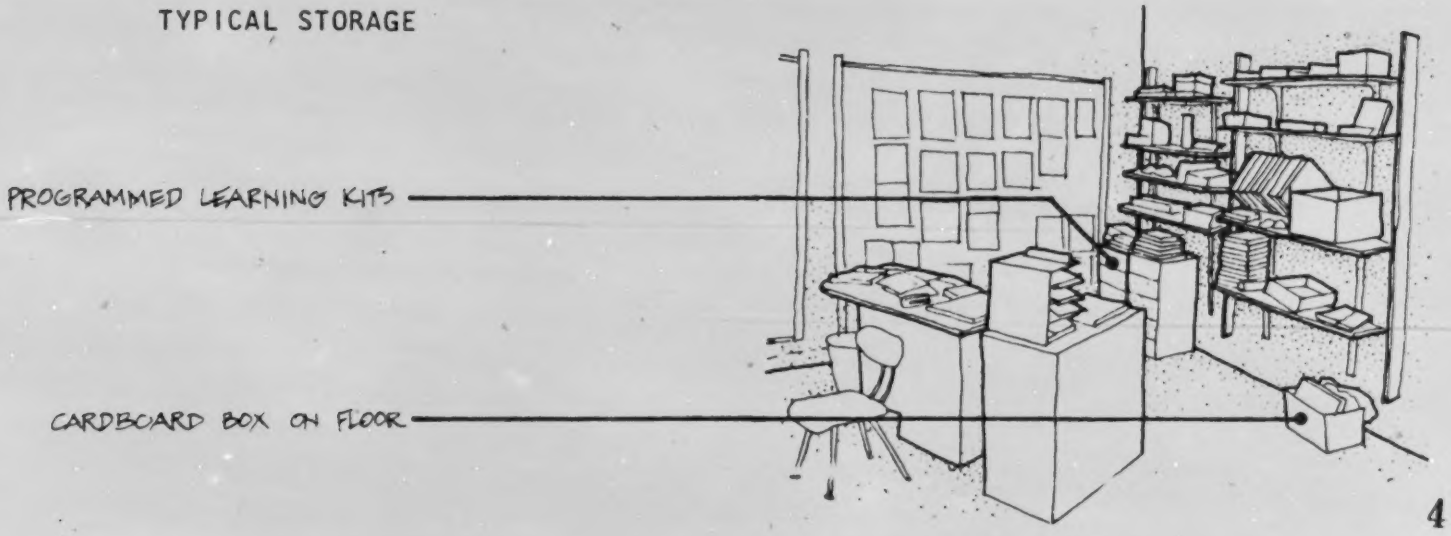




STORAGE : NODE AT SMITH SCHOOL



TYPICAL STORAGE



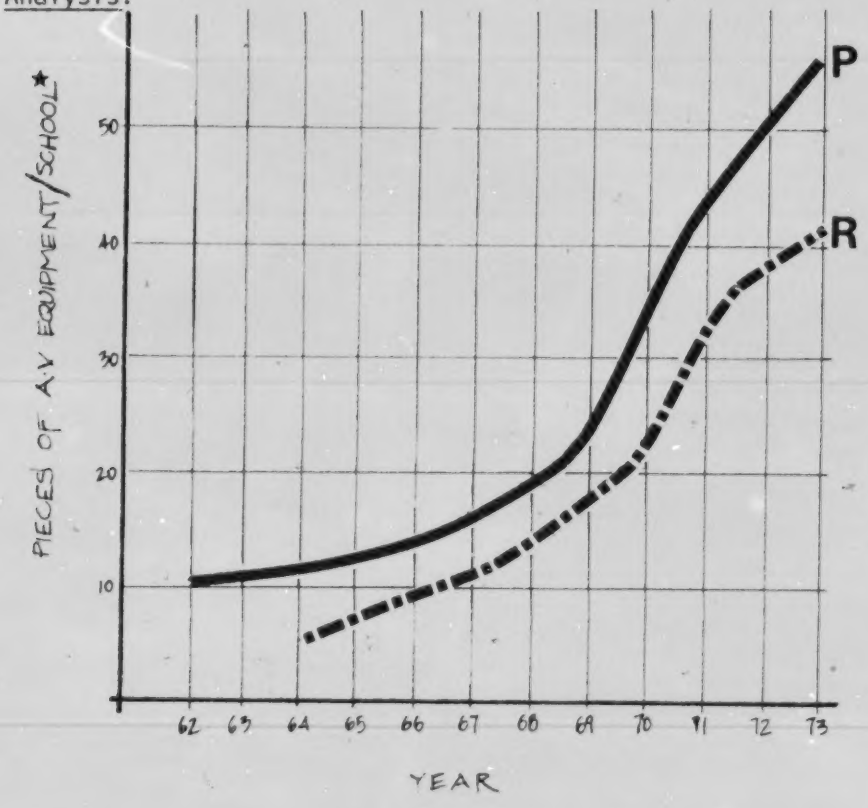
AUDIOVISUAL STORAGE

Performance required: Provide adequate storage for audiovisual equipment.

Method: See 'Storage Capacity'

Analysis:

A-V GROWTH



*INCLUDES: OVERHEAD, 16 MM. & FILMSTR.? PROJECTORS; RECORD PLAYERS, TAPE CASSETTE PLAYERS, CARTS

All the schools are fully equipped with a variety of audiovisual equipment; movie projectors, overhead projectors, filmstrip projectors, phonographs, tape and cassette recorders, etc. The school corporation has a central film library and TV studio and each school has videotape equpment for use by teachers and students. Students can even borrow cassette recorders and tape for home use.

The intensive use of audiovisual equipment is a recent phenomenon and schools planned a decade ago do not provide the activity support necessary. At the Parkside and Richards Schools this is evident in the lack of storage for such equipment. Equipment is in classrooms and in the library, taking up needed area in both places. Classroom storage of this equipment does make it immediately accessible thus encouraging its use; however, the way this accessibility is achieved is detrimental to other activities. Storage of this equipment in the library and conference rooms is a serious detriment in these schools.

At the Smith School, planned later than those just mentioned, storage is handled more adequately. The library is large and has sufficient area (about 300 sq.f.t) for central A-V storage. The nodes as unprogrammed 'opportunity areas' are used for A-V storage - a location close to the classroom providing immediate access.

Mt. Healthy School has a 'mini instructional media center' (I.M.C.) for each level (2 grades) in the school. This area, proximate to all classrooms and provided with adequate electrical outlets, is meant for the storage, accessibility and use of A-V equipment. In fact A-V equipment is found every place in the school including, but not especially in, the I.M.C. However, the open plan and large areas of this school do not hinder other

activities while still providing for A-V requirements.

Findings: Approximately 60 cubic feet of storage per classroom for audiovisual equipment should be provided in elementary schools. 20 cubic feet in a central location for storage and access of unique pieces of equipment and 40 cubic feet within or easily accessible from the classroom.

ROOM DARKENING

Performance required: Provide adequate visual environment for images projected by audiovisual equipment.

Method: Comparison with existing standards. Measures of illumination and illummance were made in a sample of classrooms in each school. See section on lighting in the Field Test Manual for equipment and methods used.

Analysis: Recommendations (source: Time Saver Standards, I.E.S. Lighting Handbook, 4th ED.) are 0.1-0.2 footcandles. Task/sourround ratios were not considered significant because of the short duration of presentations (unlike cinemas).

The Parkside School had from 4-11 footcandles in typical classrooms - unsatisfactory conditions for viewing projected images due to lack of contrast. Smith and Richards had satisfactory performance (0 footcandles). Because Mt. Healthy's overhead skylights are not shaded conditions are unsatisfactory for viewing projected images.

For all-school and large group film or slide presentations the gyms are satisfactory at the Smith and Mt. Healthy School. Parkside and Richards gyms have many unshaded windows in their multipurpose rooms and performance is unsatisfactory.

Findings: Classroom and assembly rooms should be provided with means for darkening them to the 0-1 footcandle level. The shades at the Parkside School are not opaque to light and their replacement would eliminate this problem. Because of the teaching flexibility at Mount Healthy an area in each 2 grade levels can be modified to ensure proper conditions.

ELECTRICAL OUTLETS

Performance Required: Provide sufficient quantity and accessibility of outlets.

Method: Comparison of standards with electrical outlets in schools. Comparison of existing outlets with needs.

Analysis:

	P	R	S	M
# OUTLETS/CLASSROOM	2	2	2	4
LOCATION	F,R	F,R	F,R,S,	VARIES

F - front of room
R - rear of room
S - side of room

There is now a great deal of audio visual equipment available in all the schools studied (see p.b12). Outlets are also needed for other purposes - aquariums, Christmas lights, electric fans, incubators, etc.

The number and location of outlets at the Parkside, Richards and Smith School is inadequate. Mount Healthy has an adequate number of outlets in satisfactory locations. In a questionnaire given to teachers at the Parkside and Richards school only one teacher (of 24) did not express dissatisfaction of the existing number and/or location of outlets.

Findings: Well placed outlets are more basic to successful activity support than the quantity provided. The schools cited above provide neither atribute. Few student groups can use outlets simultaneously and more should be provided (4/classroom can supply 7-8 groups of 4 students each) with the ability to add even more in the future to accommodate possible changes in teaching. (See Chapter 4 Growth and Change). Outlets should be placed where groups can use them (towards the sides and rear of the rooms) with only 1 up front at the board. A centrally located floor outlet would be useful for class audiovisual usage but many building codes necessitate a raised (non-flush) receptable which would rule out this possibility. The use of a centrally located ceiling outlet or the newly developed 'power pole' are better solutions.

W'NDOWS

The architect's intention for window usage is multifold. It is to provide a view outside and to allow natural light into the building. It may also provide a sense of place for activities and projects (e.g., plants).

What happened to the windows 'in use'? We noted in a previous report (Technical Factors) that certain schools had serious performance problems in lighting due to extensive window areas in and window placement in the classrooms. Do these findings affect use and performance? Measures were made of window shade manipulation to compare intended use with actual use and to analyze factors that reenforce or discourage the architect's intentions.

WINDOW USAGE

Performance required: The window should:

Provide a view and a link with the outside
Provide natural light
Possibly provide a place for activities

Method: A window shade study, done on a sampled basis at different times of day and different types of weather. This study indicates whether the windows are actually used as intended or whether technical problems such as glare and contrast ratio interfere with such use. The characteristics of the different window (size, location, orientation) will provide information on which windows were most 'successful'. Openness of the windowshade is used as the measure of 'usefulness'.

Analysis: The windows, on the average, were 48% open. There is great variance between the performance of different windows - some types were 88% open. That is, the shades were virtually always open reenforcing intended usage. Other types of window had their windowshades almost always closed - they were only 10% open.

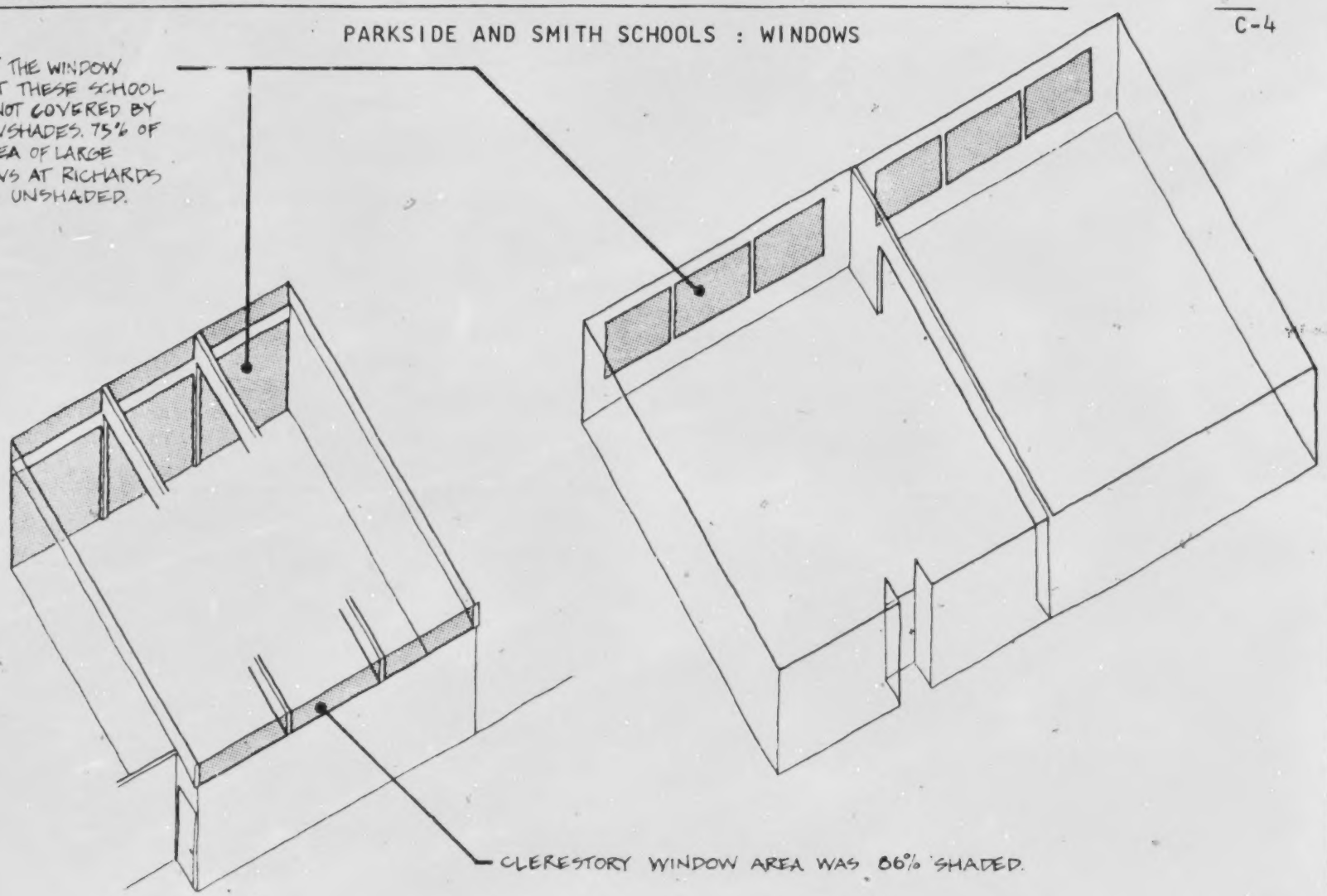
- Smaller window areas, such as those at the Richards School, are found to be much more open (unshaded) than those schools with extensive window areas. 75% of the window area at the Richards School was left unshaded, only 43% of the large windows, at Parkside and Smith Schools, were unshaded.

- Smaller window areas with north orientation are nearly always unshaded (8 % open). These windows, at the Richards School, are most 'successful' in terms of fulfilling intended use.

C-4

PARKSIDE AND SMITH SCHOOLS : WINDOWS

43% OF THE WINDOW AREA AT THESE SCHOOL WERE NOT COVERED BY WINDOWSHADES. 75% OF THE AREA OF LARGE WINDOWS AT RICHARDS (C-4) IS UNSHADED.



CLERESTORY WINDOW AREA WAS 86% SHADED.

- Skyglare is a real problem: The brightness (illuminance) of the sky is in the range of 1000-5000 footlamberts while the interior of the classroom may have sarge surfaces with 20 footlamberts. This causes problems in contrast ration and discomfor/disability glare. In classrooms with extensive windows where the sky is visible, only 1% of all window area was fully unshaded. Shades were invariably drawn halfway down to eliminate this problem. At the Richards School smaller windows, (7'x12') for the most part located in the rear of the classroom, did not subject the users to sky glare. Fully 31% of the windows were fully open - the windowshades were unused.

- Clerestores: Almost all the clerestories at the Parkside School are completely shaded (only 14% of this type of window area is unshaded). Sky glare is one reason here as is the 'bother' of constantly opening and closing those 6 small shades, as well as 3 large window shades for darkening the room, etc. The teachers prefer, for both reasons, to leave the shades closed.

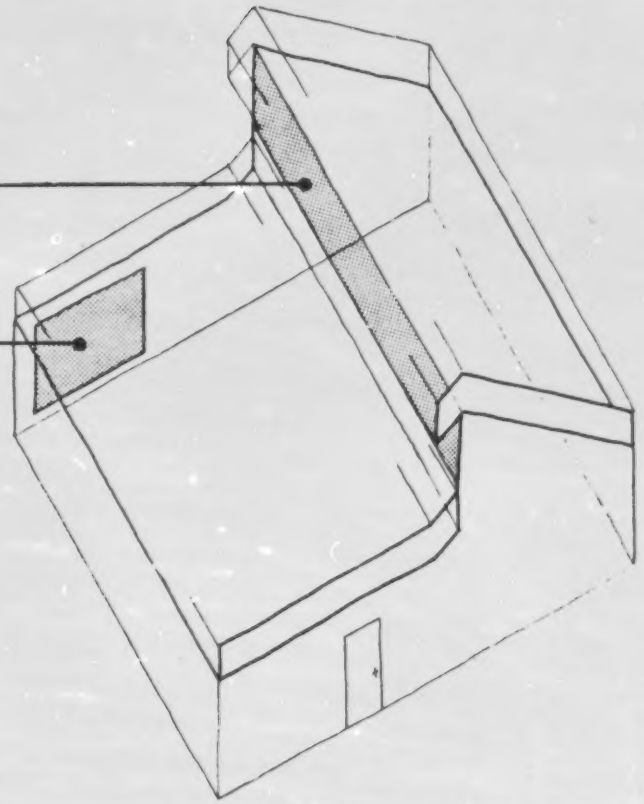
  At the Richards School 3 large clerestories are oriented east - the users cannot see the sky. Here only these 3 shades plus a single windowshade must be manipulated for A.V. presentations. 75% of the area of the clerestory was unshaded.

- Orientation: This was less of a determinant than window space and location. North facing windows were only slightly more open (59%) than south facing ones (50%).

Findings: The actual usage of the windows is strongly determined by techical factors such as glare and room contrast ratios. Large glass areas with exposure of users to the sky glare should not be present (unless a low transmittance glass is used). Windows should be located in the 'rear' of the classrooms. The use of skylights and clerestories is a large expense and should be designed to minimize glare and for easy use.

WINDOWS : RICHARDS SCHOOL

WINDOWS AT THE RICHARDS SCHOOL ARE USUALLY OPEN (UNSHADED). THE LARGE WINDOW IS IN THE REAR OF THE ROOM; THE SKYLIGHT CANNOT BE DIRECTLY SEEN BY SEATED CHILDREN. DIRECT GLARE & CONTRAST RATIOS ARE THUS MINIMIZED.



FUNCTIONAL AREAS

SUMMARY

Each of the elementary schools studied, although similar in size and student population, is the product of different programs, different times and architectural designers. The results are dissimilar concepts, areas, sizes and functions for each school. This section of the Functional Factors report examines areas and attempts to measure their performance in supporting intended activities.

Measures of performance were made by analyzing photo documentation and noting behavior and activities over a two and a half month period from April through June 1974. Each area was randomly sampled 18 times on different days and at different times. Additional informal reconnaissance and photo documentation took place for a year before the formal sample began. Questionnaires, interviews and unobtrusive measures (records, traces) also were used when appropriate.

THE FORUM

The forum is a 20'x40' area in the center of the upper grade wing of the Parkside School.

> "It has no permanent furniture, so it is spacious; two or three classes can be assembled to share a lecture or demonstration here. Yet, owing to the several level floor (3 steps sourround a central area) a bare handful of students do not rattle around in the space; they can be consolidated on the lowest floor level for easy direction."
> Arch. Forum Nov. 1962.

Cushions were originally provided for the steps but the entire area has been carpeted within the last few years.

The area was examined to determine if it was used as intended and what attributes did cause the type of use it received.

Performance Required: Provide an area which can be used by classes, singly or together for group activities, presentations and events.

Method: See "Functional Areas-Methods". The weekly forum sign-up sheet used to reserve the space was another indicator of use.

Analysis: The forum is a well used and important space in the school. The teachers at the Parkside School evidentely agree. In a questionnaire given them they unanomously agreed that 'every school should have one'.

The forum is used formally (teachers sign up for it) by 3-4 classes each day and informally by small groups of students. It is occupied about 50% of the time based on our sampled observations. A variety of activities take place here: book fairs, play rehersals, physical play, studying, discussions, guest speakers, films and library story readings. The book fair may draw 50 people to this area and often only 2-3 students studying together may be found in the space. Proximity to the upper grade classrooms does affect its use - 7 of 8 upper grade teachers use it 'often', according to our questionnaire, while only 50% of lower grade teachers (3 of 6) mentioned using it 'often'.

Findings: Notwithstanding that this is a traditional elementary school there is indication that if given innovative teaching opportunities and amenities outside of the classroom that they will be well used. The 'Forum' seems to be successful, as in-

tended, for a variety of activities and numbers of people. Its best atributes seem to be its proximate and easy accessibility, freedom from distractions and attractive design. The steps, especially, were used for sitting for a range of activities and numbers of users.

COURTYARDS

Each of the two wings of the school has an enclosed (20'x40') courtyard. Full height windows surround these areas and they are proximate to all classrooms. Access is via glass doors and amenities are provided - a reading circle for the lower grades and a work bench in the upper grade courtyard. Each is primarily paved with flagstones and has planting areas.

Performance required: Provide an outdoor space for group and class activities such as reading, planting, etc.

Method: See "Functional Areas-Methods". Interviews and a questionnaire also provided valuable information.

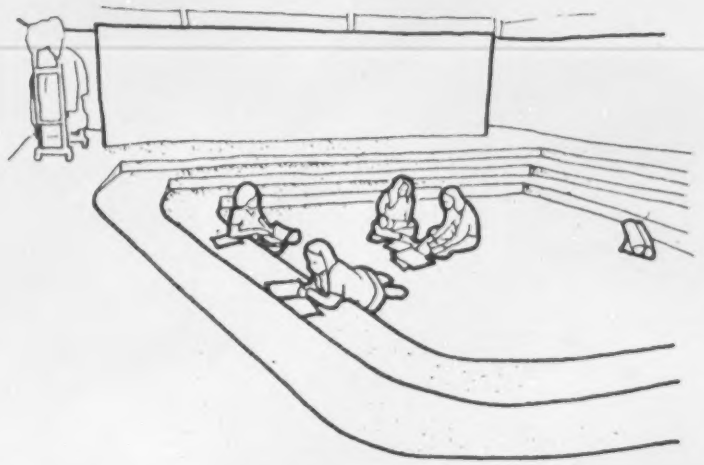
Analysis: The activity sampling was done at the most propitious time of year for outdoor activity - from April through June. Notwithstanding this, only one courtyard was used and only on one occasion. The lower grades' courtyard was not used once - the upper grade courtyard was used only once - by four boys standing around the workbench conferring about their textbook. In the year-long, informal 'reconnaissance' prior to the measured sample, we only found the courtyards used once.

Interview and questionnaire data strongly indicates that weather is largely responsible according to the teachers. "It's too hot, sunny or breezy.", "Uncomfortable", "Glare is bad." are typical comments.

Findings: This area does not fulfill its intended use. It is not used and even with improved amenities its future usage is questionable. Weather, including the glare and heat from the surrounding windows and the flagstone pavement is the strongest hindrance. Other possible hindrances are, distractions in the surrounding corridor, the size and materials of the area limiting play activities and even acoustical problems because of the prevalence of 'hard' materials.

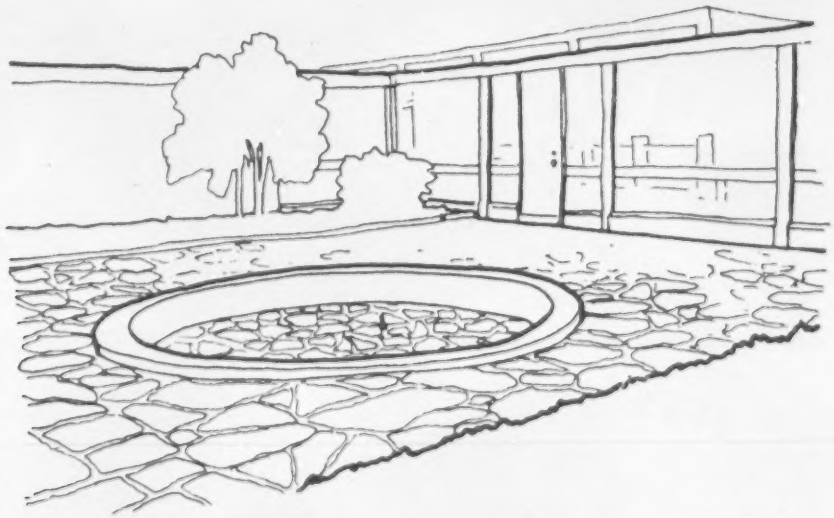
The teaching couryards at the Richards School, directly accessible from all classrooms, were even less used than those at Parkside. Here, again, a strong concept seems to be based on a faulty premise.

PARKSIDE : FORUM



THE FORUM IS OFTEN USED
INFORMALLY BY STUDENTS
FROM SOURROUNDING CLASSROOMS

PARKSIDE : COURTYARD



LOWER GRADES COURTYARD.
THIS AREA WAS NEVER USED

MULTIPURPOSE ROOMS/GYMS

The two earlier schools (1962, 1966) have multipurpose rooms - a combination gym, cafeteria, assembly space, etc. The Smith and Mount Healthy Schools have separated the gym and cafeteria functions.

At the Parkside, Smith and Mount Healthy Schools the multipurpose room or gym is removed from the center of gravity of school activities; however, at Richards it is literally and figuratively (in size, location, accessability and form) the center for activities. We attempted to test if this powerful concept was viable. We also examined the multipurpose room concept vs. the separate gym and cafeteria.

Performance Required: Provide an area to be used for

Physical education
a cafeteria (multipurpose room)
events and assemblies

Method: See "Functional Areas-Methods". Only the Richards (central multipurpose room) and Smith Schools (remote gym) were observed on a regularly sampled basis. Questionaires and interviews were also used.

Analysis: Since the observational data was collected during April and May, months of mild weather in Columbus, Indiana, this would have an effect on the amount of physical education activities. However, the di inished activity should be equal in both facilities.

Both areas were being used during just over half of the observations. The uses, however, were very different. At the Smith School physical education activities were being held each time, with one exception.

At Richards only 2 of the activities observed (20%) were physical education - others were groups working with teacher aides (40%; 4 times), and rehersals and dramatic activities (30%; 3 times). The dedicated nature and removed location of the gyms at the Smith and Mount Healthy Schools both contribute to their single use as physical education facilities.

The Parkside and Richards Schools multipurpose rooms are neither dedicated nor as removed as the more recent schools. Each is used as a cafeteria and furthermore, Parkside uses the stage area, opening onto the major space, as a music classroom. The cafeteria function does inhibit physical education activities due to the set up of cafeteria tables during the morning and their removal and clean up during the afternoon. The acoustical quality of these multipurpose spaces (see Technical Factors - Acoustics) is another obstacle to the use of this room for gym activities.

Findings: The data does reflect these attributes. The Richards multipurpose room, while not supportive of gym activity is supportive of ad hoc small group activities. Its proximity to classrooms, the availability of the cafeteria tables during non-cafeteria hours and the relatively satisfactory acoustics for smaller, quieter activities does occasionally attract small groups of students. This, we believe, indicates the need for group activity spaces and not the particular success of the multipurpose room for this purpose.

The separate gym seems maore successful. To provide a minimum P.E. program for the eighteen classes in each school, a fulltime area is necessary. Our data seems to indicate that a separate gym is used for that purpose.

LIBRARIES

Each elementary school examined in this study has a school library - though the earliest, the Parkside school, originally didn't have one (see 'Growth and Change'). In each school the relationship between the classrooms and the library is different and this may have some effect on the way this area functions.

- At Parkside, the Library is located in the center of the upper grade wing and is easily accessible from all classrooms in that area.
- At the Richards school the Library is located in the administrative wing and is not easily accessible from any classroom.
- At Smith the Library is separated from the classrooms by two levels.
- At the Mt. Healthy school the Library is central to all classroom areas and accessibility is easy if not mandatory - the major corridor 'spine' in the school goes through the 'open' library.

In this school system four schools share a librarian - the librarian is in each school only 3 days every two weeks. At other times, library aides and parents staff this function.

Performance Required: provide access to books, sufficient book storage, seating and desk room and a librarian's area.

Method: see "Functional Areas - Methods".

Analysis: The first indicator explored was the amount of use the library received.

LIBRARY USAGE

	P	R	S	M
TIMES OCCUPIED/TIMES OBSERVED	16/18	15/18	13/18	9/14
PERCENTAGE OCCUPANCY	89%	88%	72%	64%

The pattern above is not revealing in relating library usage to classroom proximity.

The following data indicates the type of group using the library. Independent groups were informal, small groups who were not part of a larger formal library use group. Large groups were part of teacher organized activity.

TYPE OF GROUP

	P	R	S	M
INDEPENDENT GROUPS OBSERVED	22	9	7	5
ORGANIZED GROUPS OBSERVED	4	9	7	9

The libraries differ substantially in the type of group using this area.

Findings: The proximate location of the library at the Parkside school combined with the need to conduct small group activities outside of the classroom proper has made the library (and the Forum too!) actively used for this purpose. It's role, in terms of small groups meeting, is that of the multipurpose room at the Richards school though, of course, it physically supports these small group activities much better. In the lower grade wing at Parkside the corridor often contains these activities lacking alternatives (see "Functional Areas - Corridors").

At Richards and Smith schools the libraries are used in more traditional ways - the more remote location makes independent ventures by students more rare. At Mt. Healthy school the library is most used by class sized organized groups and least by independent groups. This may well be because of the open nature of the classroom areas where there are many areas where small groups can meet. However, the large amount of organized large groups seems at variance with the school's philosophy.

SCHOOL SECRETARY AREA

At the elementary school studied there is a school secretary. This individual's responsibilities include answering phone calls, school attendance, correspondence and reception.

At the Mt. Healthy and Parkside schools the secretary's area is at the entrance, easily visible and accessible. At Richards it is near the entrance but not visible from it; at the Smith school it is far removed (3 levels) from the entrance.

Two major patterns were examined - the role of this individual (and area), in the school and which environmental attributes affected behavior in this area.

Performance Required: The school secretary provides the following services:

- receptionist
- school correspondence
- school attendance
- phone answering

Method: See 'Functional Areas - Method'. Insufficient data was collected in this area at the Mt. Healthy school. In addition, at one of the schools, the secretary tabulated her tasks on two typical days.

Analysis: The school secretary's area is always occupied by the school secretary who, in addition to the above tasks, is involved in other activities:

- sells lunch tickets
- cares for sick students (nurse is shared with another school)
- sells school notebooks, pencils, etc.
- distributes mail
- handles public announcements
- duplicating

The location of this room and the amenities provided may even determine additional uses of this area:

Parkside: immediate proximity to classrooms and the need for activity space outside the classroom allows students to work in the school secretary/entrance area. In over half our observations groups of students - usually with a teaching aide - were working in this area on a folding table.

Richards: The school's duplicating machine, supplies and comfortable seating are located in the school secretary's area. A great deal of teacher activity takes place here! In 13 of 15 observations of behavior this area contained teachers either preparing material or having discussions. Note that Parkside had no teacher activity in this area.

Smith: Virtually no student or teacher activities in this area. It is separated vertically and horizontally from classroom areas and contains no seating or work areas for teachers.

Findings: The location of the room and the amenities provided determine the 'personality' of the school secretary area. Even minimally it is the 'hub' of the school containing mailroom, supplies and much of the student commerce in the school. This can be further reinforced however, as seen at the Parkside school where student work can occur at Richards where teachers prepare material and exchange ideas.

The entrance areas at the Richards and Smith schools - where the secretary is not located in the entrance - do not have amenities or the location to reinforce behaviors. Occasionally displays are present but we did not see but one activity in either of these spaces in any of our observations.

CIRCULATION AREAS

During our reconnaissance of the four schools we noted that their major circulation areas were liberally used for non-circulation activities. These areas, then, originally intended for only circulation, attracted our attention and were added to the previously designated 'functional areas'.

The layout of these circulation areas varies considerably between schools: (see diagrams, p. D-17).

At Parkside, circulation is split in two separate wings (upper and lower grades) and each wing is again split - into north and south corridors

At Richards, circulation is split in two, serving upper and lower grades. Because of the classroom layout 6 'stub' corridors are created each serving only one classroom.

At the Smith school the enclosed ramps form the major circulation path which is a rising spiral. At each level the ramp opens onto a larger glass encased 'node' off of which branches a corridor serving 6 classrooms (2 grade levels).

At Mt. Healthy school a single corridor 'spine' serves the entire school. Most school activities are partially open to the spine or visible from it. The spine includes two large niches one of which is used as a portion of the library.

These circulation areas were examined to determine to what extent uses other than those originally intended occurred in them.

Performance required: Circulation area for the school

Method: See 'Functional areas - Methods'.

Analysis: Usage for non-circulation activities was quite high in all of the schools. Yet these are optional activities and these circulation areas do not contain supports - lighting, furnishings, finishes - for these activities.

CORRIDOR USAGE

	PERCENT OF OBSERVATIONS OCCUPIED (non-circulation activity)
PARKSIDE	
LOWER GRADES CORRIDOR	61%
UPPER GRADES CORRIDOR	45
RICHARDS	
LOWER GRADES CORRIDOR	27
UPPER GRADES CORRIDOR	0
STUB CORRIDOR	52
SMITH	
LOWER GRADES CORRIDOR	33
UPPER GRADES CORRIDOR	44
NODE - LOWER GRADES (1-2)	27
NODE - MIDDLE GRADES (3-4)	16
NODE - UPPER GRADES (5-6)	39
RAMPS	0
MT. HEALTHY	
SPINE	44

97

The number of groups using each corridor was small. In 83% of the observations a single group of children was present. The number of children per group was also quite small - of 83 groups observed 29 (31%) were of a single student; 30 (33%) consisted of 2 students in a group; and 11 (12%) consisted of a three student group.

In most of these groups the students were doing 'pencil and paper' activities (42%) or working together (34%). A further 16% were working with 'materials' - cutting, pasting, drawing. In other words, more passive class associated activities predominated.

Within each school specific circumstances determined differing frequencies and types of use.

Parkside: The lower grade corridors are more frequently used than those in the upper grade wing. As previously noted, the upper grade wing has the library and forum (p. D-8 and D-2) which are often used for small groups. The lower grade wing, lacking these facilities, uses the corridors more extensively. In the lower grade wing, only 3 classrooms share each corridor providing more seclusion than the corridors for the upper grades where 6 classes open onto this area.

Richards: Richards corridors are the least used. Each of the two major corridors is shared by 9 classrooms and is easily visible from the school's entrance area creating a 'public' quality. It also lacks the variegation which the niches at Parkside provide.

One particular 'stub' corridor is quite active. It serves a number of classes as central storage for programmed learning material which is heavily used.

Smith: The ramps are not used for non-circulation activity, however, the nodes and the branch corridors to the classrooms frequently contain small groups.

While the ramps are busy with circulation, the nodes create eddies and backwaters in this main circulation path which are not disturbed and do get some measure of activity. The upper grades 'node', by far is the largest, (approximately 441 square feet of usable space), gets the most activity - in 39% of our observations it was occupied by small groups of students. The other nodes (295 square feet and 233 square feet of usable space) are not large enough to become as removed from the major circulation.

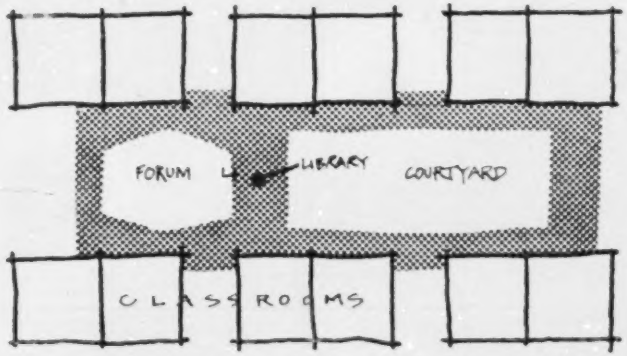
The classroom branch corridors are independent of the main spiral circulation. Shared by only 6 classes which are team taught, these areas are often used by small groups notwithstanding the inadequate lighting and small area (the corridor is only 8 feet wide).

Mt. Healthy: The spine at Mt. Healthy is used for non-circulation activities though not as much as in the other schools. As noted in 'Functional areas - Library' (p. D-8), this lesser use may be the result of the rather adequate areas, in quantity and type (places where small groups can exist independently while being proximate to teachers and class area) which exist in the teaching areas.

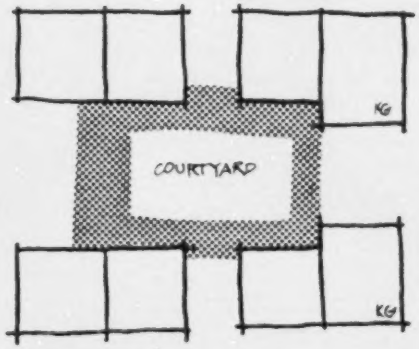
Findings: The extensive use, compared to the original intentions, of non-classroom areas, especially circulation areas with their attendant environmental difficulties, indicates a real need for attached ancillary areas near the classroom.

The use of circulation areas seems to be determined by the proximate location of such areas to classrooms and by their privacy - or the number of classes which share it and its removal from public scrutiny. Unexpectedly, it's environmental conditions - these areas are not furnished, some are not carpeted, inadequate lighting and acoustical conditions prevail - seem no barrier to their use though the detrimental conditions may inhibit a greater frequency of usage.

CIRCULATION DIAGRAM :
PARKSIDE SCHOOL

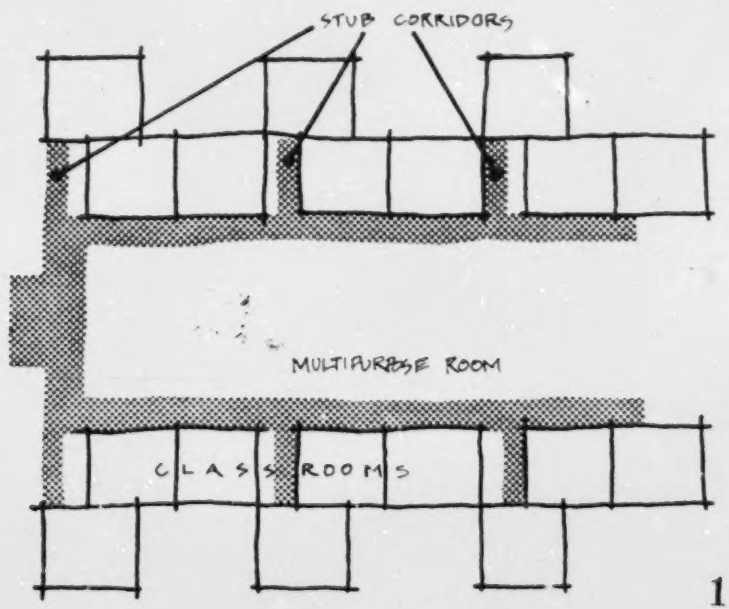


UPPER GRADES WING

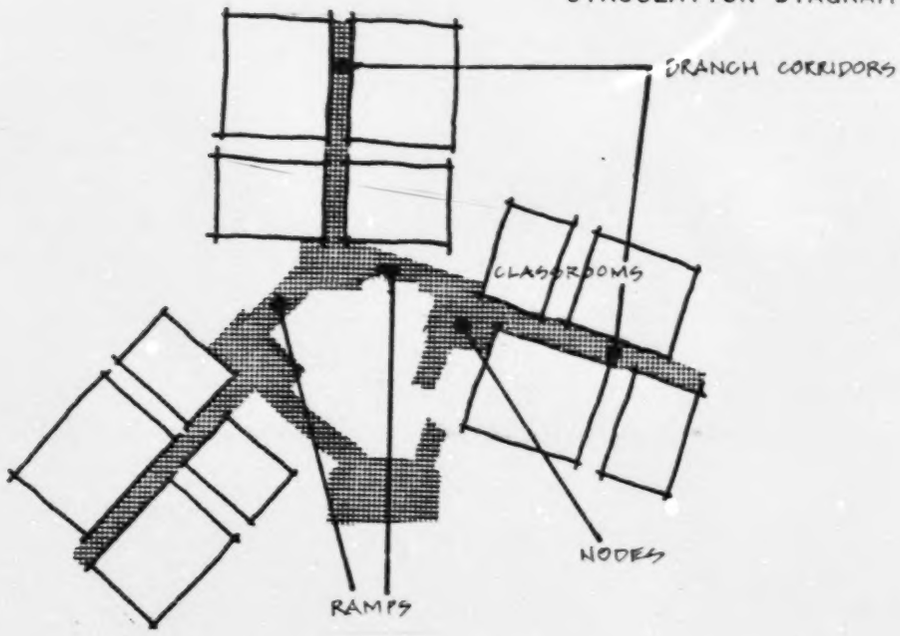


LOWER GRADES WING

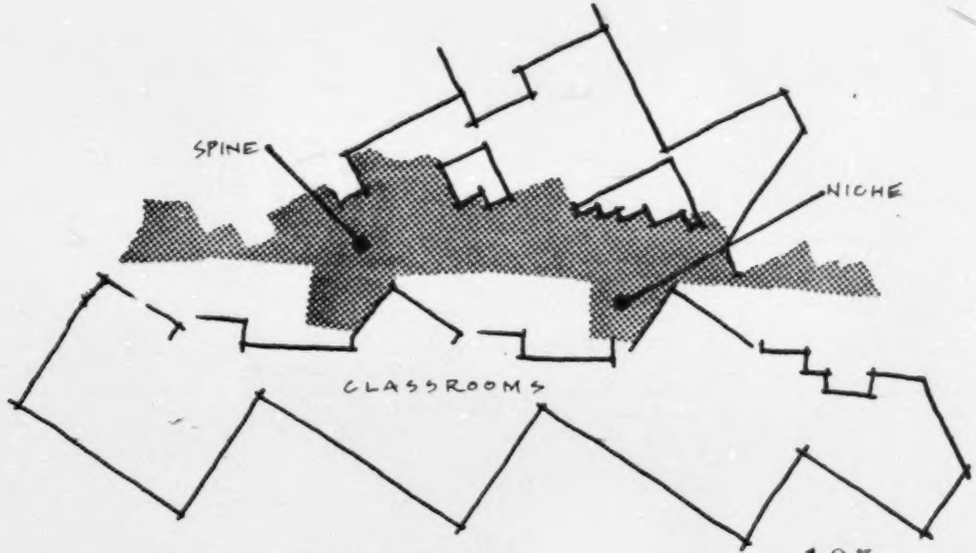
CIRCULATION DIAGRAM : RICHARDS SCHOOL



CIRCULATION DIAGRAM : SMITH SCHOOL



CIRCULATION DIAGRAM : MT HEALTHY SCHOOL



RICHARDS SCHOOL : STUB CORRIDOR

PRIMARILY USED FOR 'ACTIVE STORAGE' OF PROGRAMMED LEARNING MATERIALS. HERE A TEACHER'S AIDE USES IT TO DO READING WITH A GROUP OF 9 STUDENTS.

SMITH SCHOOL : NODE

A TEACHER'S AIDE IS USUALLY AT THE DESK AT THE UPPER GRADES NODE. STUDENTS IN THE REAR ARE INDEPENDENTLY DOING CLASSWORK. NOTE STORAGE.

GROWTH & CHANGE

SUMMARY

The four schools we examined, though their designs span only a period of 10 years (1960-1970), are a remarkable reflection of changes in education during that period. This section of the 'Functional Factors' report documents changes in the design of these schools.

Accommodation and facilitation of change is the time dimension of function. Four major types of functional change should be anticipated in design:

- increasing standards and criteria
- new philosophies and concepts
- changes in technology
- changes in legal opinion and legislation

The changes that are documented in this report should instill some respect for time in those responsible for designing and new facilities - both architects and their clients. Certain attributes of a building are especially critical in order to avoid functional and economic obsolescence.

- GENEROSITY. Optimally sizing a room, storage, and even services to exactly meet today's needs will hasten the onset of obsolescence in capacity and use.

- FLEXIBILITY. Allowing for the removal, alteration and relocation of walls and services

- EXPANSION. Accommodation for building additions with minimum disruption

- INTERCHANGEABILITY. Providing parts of the building which can be replaced with other components

Providing these attributes not only facilitates modification of a building's function but also responds to a change in function - for instance, if enrollment in a school declines, the building can be easily converted to another use, thus retaining economic value.

CHANGES IN STANDARDS

DISPLAY AND STORAGE

Display and storage needs increased greatly during the decade examined in this study (see p. A-6 and B-2). The growth in educational materials and equipment has been substantial and even the figure recommended for storage (p. B-3), adequate for today's needs, will be unsatisfactory in 5 years.

LIGHTING

Standards for the quality and quantity of natural and artificial light have been changing and based on work now in progress, will continue to change during the coming decade.

Older school buildings depended on large expanses of window for lighting and ventilation. With the common use of mechanical ventilation for heating and cooling and high output artificial lighting in schools, windows are literally no longer required. Window configurations should now be based on other criteria.

The large windows at the Parkside and Smith schools cause more problems (p. A-3; C-2) than they provide amenity. At Richards however, the window is generally used to create a place in a corner of the classroom and at Mt. Healthy only 2 of 6 class areas in a 'cluster' have large amounts of glass.

The quantity of artificial illumination in each school is now adequate. Parkside did not meet accepted quantity standards and the addition of a row of lighting remedied this problem. Recent thinking, however, which has not yet evolved into practice, emphasizes the quality of lighting - especially the importance of contrast. If this concept were applied to Parkside's original

lighting configuration along two walls of the room - it could well be superior to the 'improvement' which was made.

CHANGES IN AREA

LIBRARY

The libraries in the schools studied are the best measure of change in areas for different activities.

The Parkside school design was based on the concept of the classroom library. As concepts in this area changed, a central activity area was easily converted into a well located, if small library (612 square feet).

SIZE OF LIBRARY

PARKSIDE	612 Sq. Ft.
RICHARDS	1050
SMITH	2000
MT. HEALTHY	1560

As shown in the accompanying figure the trend towards larger library areas is generally consistent. An elementary school in this district, completed in 1974, has a library substantially larger than any of the schools in this study.

PHILOSOPHICAL AND CONCEPTUAL CHANGES

TRADITIONAL & 'OPEN' SCHOOLS

The four schools clearly reflect the basic philosophical change from regimented to independent and 'open' education in elementary schools.

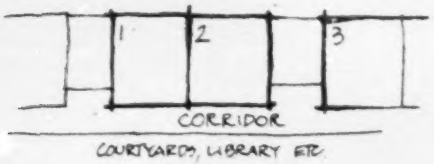
The Parkside school is in the tradition of the decades of earlier school buildings preceding it - typical 30 by 30 foot classrooms marching along corridors. This was the expected configuration at the time (1960) it was designed.

The Richards school reflects an abortive attempt to modify this concept and leans toward a 'team teaching' configuration. Originally, the two classrooms on the main corridor were to be combined into a double, team taught room, combined with the single 'outrigger' classroom to form a teaching cluster. While the concept was rejected, the original plan remains - with the double classroom sundered. Only the outdoor courtyard, which in fact is unused, is actually shared in plan. The wall separating the two classrooms is non-bearing and if the original concept was to be rejuvinated, this wall could be easily removed.

By 1969 the Smith school was able to incorporate the team teaching concept using the double and single classrooms originally proposed at Richards. The concept goes even further - 2 grades share a cluster which contains a pair of double and single classrooms.

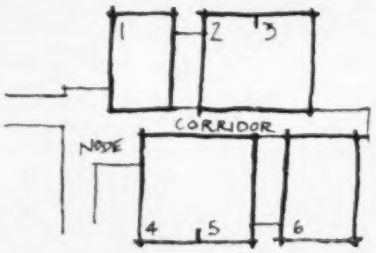
The most recent school, Mt. Healthy, is entirely 'open'. Each cluster of 2 grades has 6 potential class areas only one of which is clearly separated. Unlike any of the previous schools all students in a cluster, or any smaller number, can be com-

CHANGES IN EDUCATIONAL PHILOSOPHY REFLECTED IN BUILDING



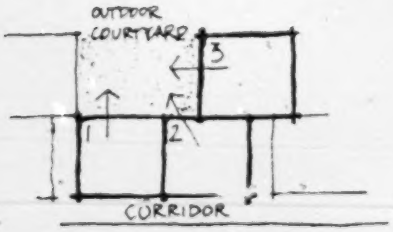
PARKSIDE SCHOOL 1962

TRADITIONAL CLASSROOMS ALONG A CORRIDOR.



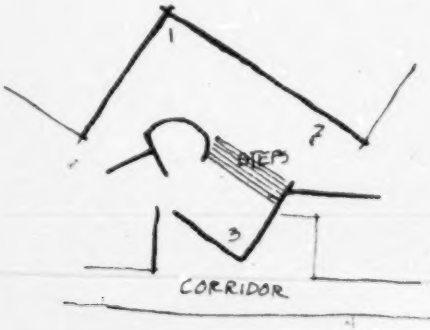
SMITH SCHOOL 1969

ROOMS 2/3 & 4/5 ARE DOUBLE CLASSROOMS, 6 CLASSES SHARE THIS 'CLUSTER'



RICHARDS SCHOOL 1966

IN THE ORIGINAL CONCEPTION CLASSROOMS 1 & 2 WERE TO BE COMBINED TO MAKE A DOUBLE ROOM.



MT HEALTHY 1972

AREAS 1, 2 & 3 ARE 'OPEN' TO EACH OTHER THOUGH 3 IS A HALF LEVEL ABOVE. OTHER CLASS AREAS ARE ALSO OPEN TO EACH OTHER.

bined in one area. Without walls around class areas, easily moveable furnishings and no assigned desks, freedom for independent action is reenforced by the design.

LIBRARY

Not only is the area of the library (p. E-4) increased but its importance and location has also undergone conceptual rethinking.

In the earlier schools, with the exception of Parkside where the library was located in the only available area, the location of the library vis a vis the classrooms is not critical. Both Richards and Smith have their libraries as far from the central locus of the classrooms as is possible. At Mt. Healthy the opposite is true - the 'resource center' (library) is centralized. The main corridor 'spine' passes directly through it and provides a maximum of contact for students with this function. In a subsequent facility - the Fodrea Elementary School - the resource center becomes the central focus of the school and the classrooms surround it, almost subserviently.

MUSIC AND ART

The Parkside school, the earliest, did not include these functions in program or design - all subsequent schools have dedicated areas for them. Presently at Parkside ad hoc measures are used. Art activities take place in classrooms - the art teacher moving materials to each room. Music takes place on the stage of the multipurpose room.

GYM/CAFETERIA

The concept of a multipurpose room for eating, recreation, meetings, presentations and dramatics evolved into the more satisfactory, if more expensive, separate gym and cafeteria. The earlier schools, Parkside and Richards, have the multipurpose room; the more recent schools separate these functions. Presentations and meetings can occur in either gymnasium or cafeteria; Smith school uses the gym while Mt. Healthy uses the cafeteria.

CHANGES IN TECHNOLOGY

EQUIPMENT

The quantity of audio-visual equipment has greatly increased in elementary schools during the past decade. Supports for the use of such equipment in the older schools - room darkening capability, outlets and storage, are not present. The more recent schools do support the present equipment but future technology may make these schools obsolete also.

While augury is not part of this study, enough prototypes and installed systems of television, individualized teaching mechanics, and computer terminals already exist to assure one that at least some of this technology will be used in elementary education. A major consideration in accommodating this change is the capacity to provide these services to many parts of the teaching areas via cables. Only Mt. Healthy, with an accessible ceiling and a most compact plan, seems to respond to this possibility.

LEGISLATIVE AND LEGAL CHANGES

This area is not a part of the 'Buildings in Use' examination per se, however, because it has become critical after many years of dormancy it is now an important consideration in growth and change and necessitates some commentary.

Three areas of legislation seem most relevant in terms of their ramifications on school facilities - provisions for access by the handicapped in public buildings; provisions for accommodating special education students in schools; and energy conservation provisions. We have not specifically examined the progress of this legislation in Indiana, however, very strong national trends in these areas are present and will soon be common. Often buildings must be retrofitted to include these changes.

FINDINGS

Findings in the area of growth and change must be based on the relatively short experience with this phenomenon in the schools studied and with some prediction of how these facilities can respond to the changes over the next 20-40 years. The criteria used are those identified earlier - generosity, flexibility, expansion and interchangeability. None of the schools are literally planned for growth and change. Notwithstanding this, however, their characteristics can inhibit or facilitate their functioning over time.

PARKSIDE. Parkside's design was originally generous enough in area to accommodate the addition of a library, the commonly seen small groups in circulation areas and a variety of activities in the Forum. Its lack of bearing walls and other encumberances

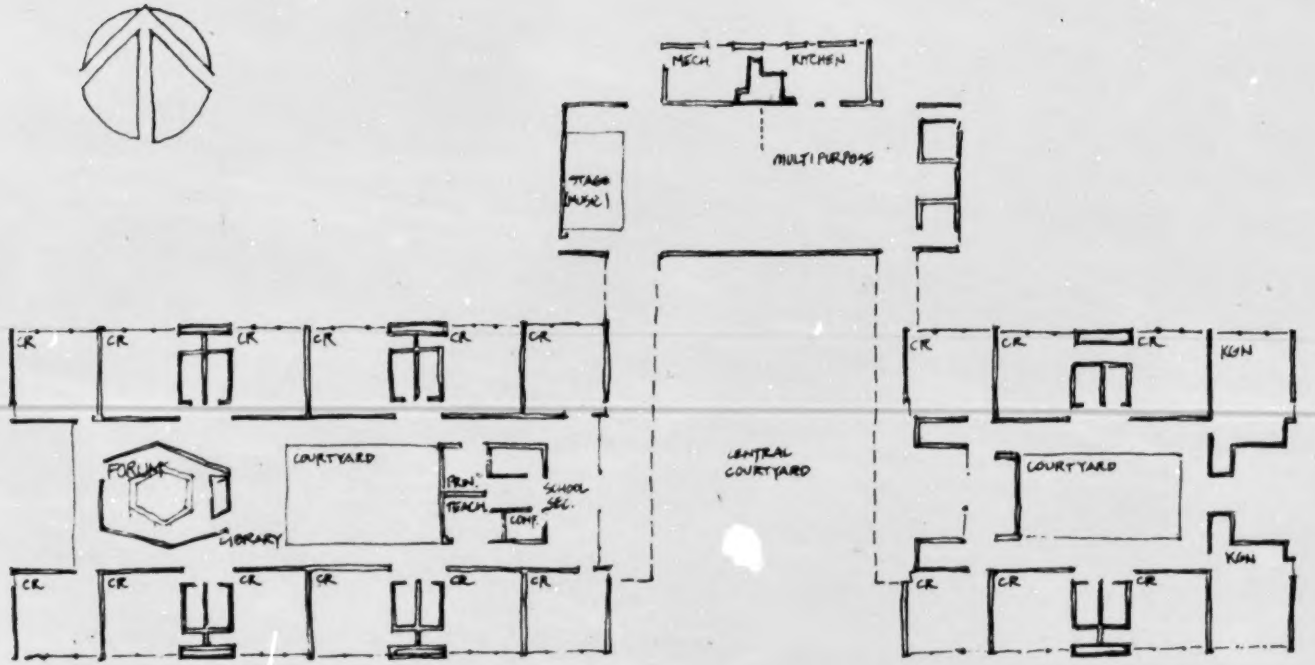
can in the future, easily allow very open education. Even the courtyards can be utilized in the future with some provision for enclosure. Expansion, if necessary, can be clearly accommodated by extending existing corridors and adding areas. Interchangeable components are at a minimum - as they are in all the schools. Introducing additional utilities, teaching machines for example, may be difficult.

RICHARDS. Richards is presently the most 'taut' school examined. It has the least area to accommodate growth. East-west bearing walls restrict change but north-south walls can be easily removed opening classrooms as originally conceived. The courtyards, heretofore unused, have potential for additional area if covered. Utilities and services could be distributed by using the space between the hung ceiling and the roof.

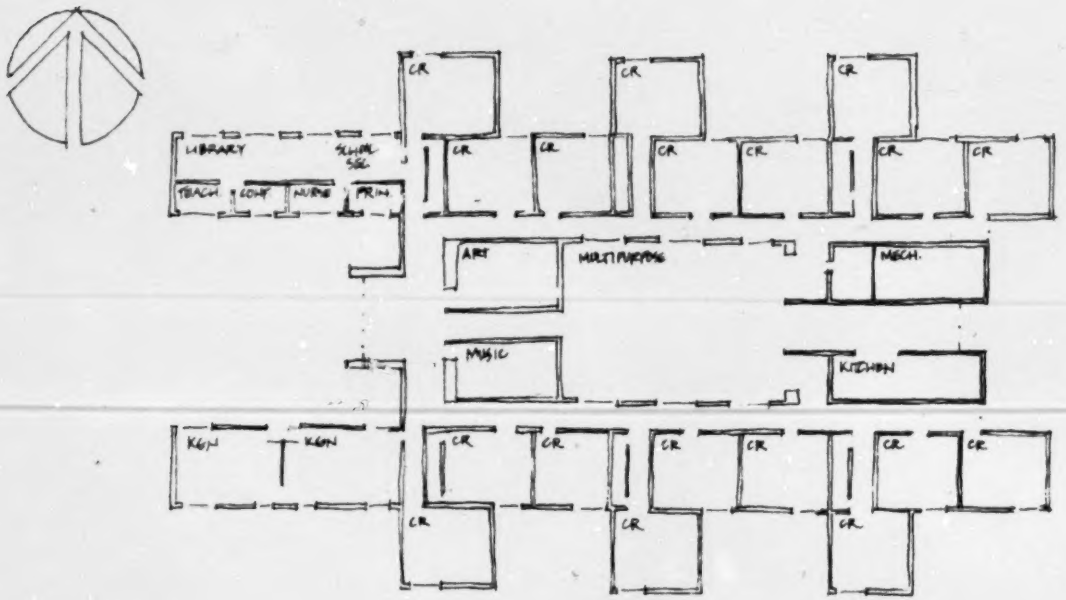
SMITH. The 'Nodes' and corridors at the Smith school have been used to supplement the existing teaching area. There is, however, no additional 'slack' area for future use and no easy way of providing this area at Smith. The existing columns can support additional floors, however the circulation to these floors - if the ramps continued upwards - would be cumbersome and not at all proximate to the classrooms. In terms of flexibility, some openness is provided by the double classroom but additional open areas are difficult to develop - the bathrooms divide the classrooms in one direction and solid concrete bearing walls in the other. The aesthetic of exposed pipes and utilities in this school makes the addition of services most easy.

MT. HEALTHY. This school is the most open and is the most responsive to change. Mobile bookshelves and storage units are already used frequently to respond to the differing area needs. Expansion can clearly be accomplished by extending the 'spine' if another cluster were appropriate. Like Smith the exposed utilities facilitates additional services or the relocation of existing ones.

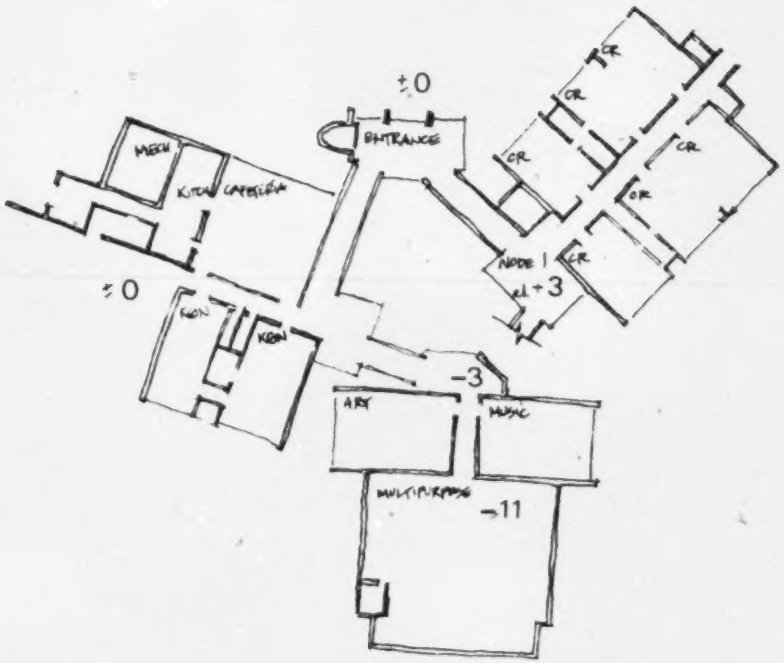
DIAGRAMMATIC PLAN OF PARKSIDE SCHOOL

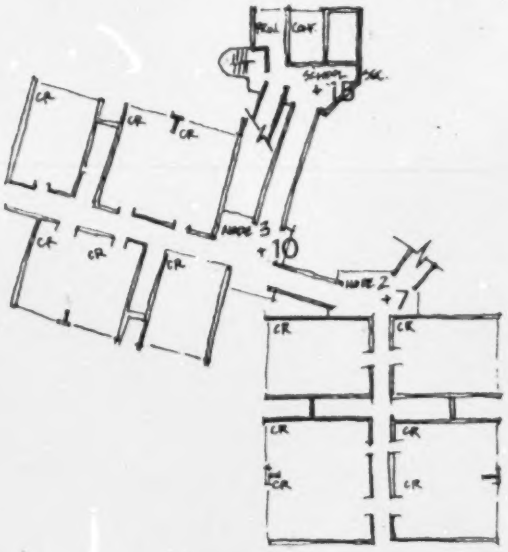


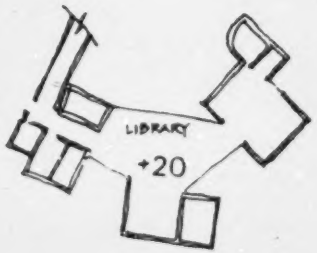
DIAGRAMMATIC PLAN OF RICHARDS SCHOOL



DIAGRAMMATIC PLAN OF SMITH SCHOOL







DIAGRAMMATIC PLAN OF MT. HEALTHY SCHOOL